



# Warmer Temperatures and Older Ages Significantly Influence Abdomen, Wing, and Tibia Size of *Anopheles gambiae*



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## Introduction

- Female *Anopheles gambiae* are primary vectors for malaria pathogen, *Plasmodium falciparum*. They acquire the parasite via blood meals from human hosts.
- Mosquitoes experience senescence, the irreversible deterioration of the body condition and the weakening of its immune system with older age.
- Mosquitoes are poikilothermic ectotherms, hence their internal body temperature varies with and depends on ambient temperature.
- How temperature influences the rate of senescence is unknown.
- Studying the interaction between age and temperature will allow us to make inferences about mosquito physiology and their immune response to infection.

## Hypothesis

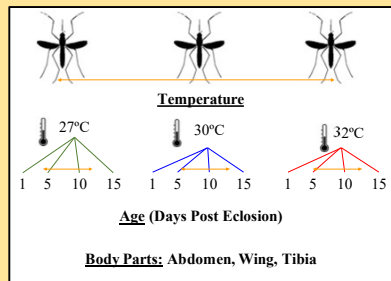
How do temperature and age influence body size of *A. gambiae*?

WE HYPOTHEZIZE THAT:

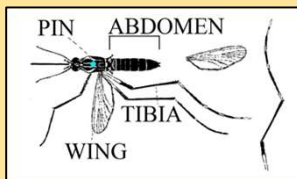
- 1) Abdomen size will decrease with warmer temperature and older age.
- 2) Wing and tibia size will remain constant.
- 3) Faster progression of senescence occurs at warmer temperatures.

## Methods

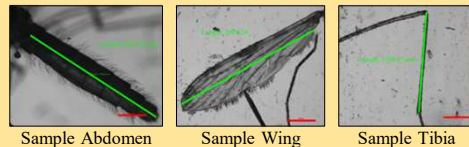
Reared at constant conditions:  
27°C, 30°C, & 32°C  
75% Humidity  
12hr Daylight



Pinning



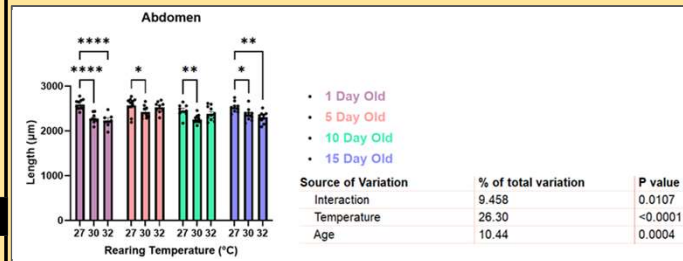
Imaged & Measured



Two-Way ANOVA in PRISM

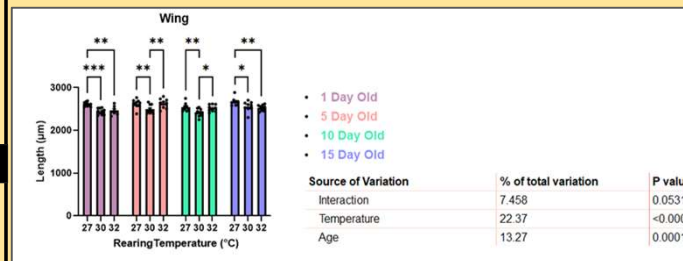
## Results

### How do temperature and age influence abdomen size?



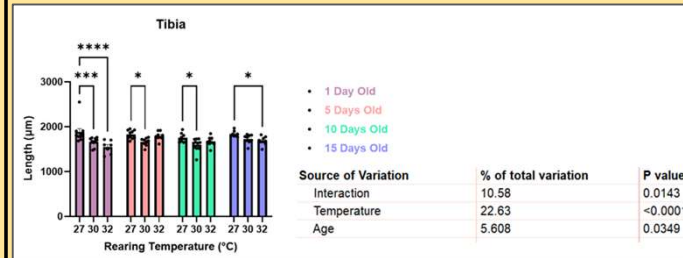
**Fig. 1. Abdomen length decreases in warmer temperatures in an age-dependent manner.** The decrease in abdomen size at warmer temperatures was most pronounced in the youngest and oldest mosquitoes. Two-way ANOVA found that temperature, age, and the interaction were statistically significant at influencing abdomen size of adult female *A. gambiae*.

### How do temperature and age influence wing size?



**Fig. 2. Wing length decreases in warmer temperatures in an age-dependent manner.** The decrease in wing size at warmer temperatures was most pronounced in the youngest and oldest mosquitoes. Two-way ANOVA found that temperature and age were both independently significant, but the interaction was not statistically significant at influencing the wing size of adult female *A. gambiae*.

### How do temperature and age influence tibia size?



**Fig. 3. Tibia length decreases in warmer temperatures in an age-dependent manner.** The decrease in tibia size at warmer temperatures was most pronounced in the youngest and oldest mosquitoes. Two-way ANOVA found that temperature, age, and the interaction were statistically significant at influencing tibia size of adult female *A. gambiae*.

## Conclusions

- Temperature, age, and the interaction between temperature & age influence the body size of the mosquito.
- Warmer temperatures decrease body size of mosquito in an age-dependent manner.
- No specific trend in body size occurred with older age, but age was found to have a significant effect on abdomen, tibia, and wing size.
- Biological vs. statistical significance?

## Limitations

### Randomness & Sample Size

Random selection is not assured and sample size is very small

### Larval Density

Conditions in larval environments influence adult body size (1)

### Constant Temperature

The mosquitoes were held at a constant temperature with no shade or temperature fluctuations

### Lab Strain (G3)

Less genetic diversity than field populations (2)

## PHYSIOLOGICAL PROCESSES

## Future Work

### Measure Males

- Male body size influences mating and insemination success, affecting number of progeny, an important factor in the transmission of malaria

### Measure Changes in Energy Storage

- Study how carbohydrate, lipid, and protein storage is altered in accordance to warming temperatures and older age

### Colder Temperatures

- Investigate effects of colder temperatures on male & female *A. gambiae* to extend trends from this study to a broader temperature range

## Acknowledgements

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## References

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2. Gloria-Soria, A., Soghigian, J., Kellner, D., & Powell, J. R. (2019). Genetic diversity of laboratory strains and implications for research: The case of *Aedes aegypti*. *PLoS neglected tropical diseases*, 13(12), e0007930. <https://doi.org/10.1371/journal.pntd.0007930>